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KINTEL
A DIVISION OF
COHU
ELECTRONICS, INC.

OPERATING & MAINTENANCE INSTRUCTIONS*
FOR
MODEL 114A
DC DIFFERENTIAL AMPLIFIER

Code No. 2PX-44

*For amplifiers having serial numbers 1101 and greater

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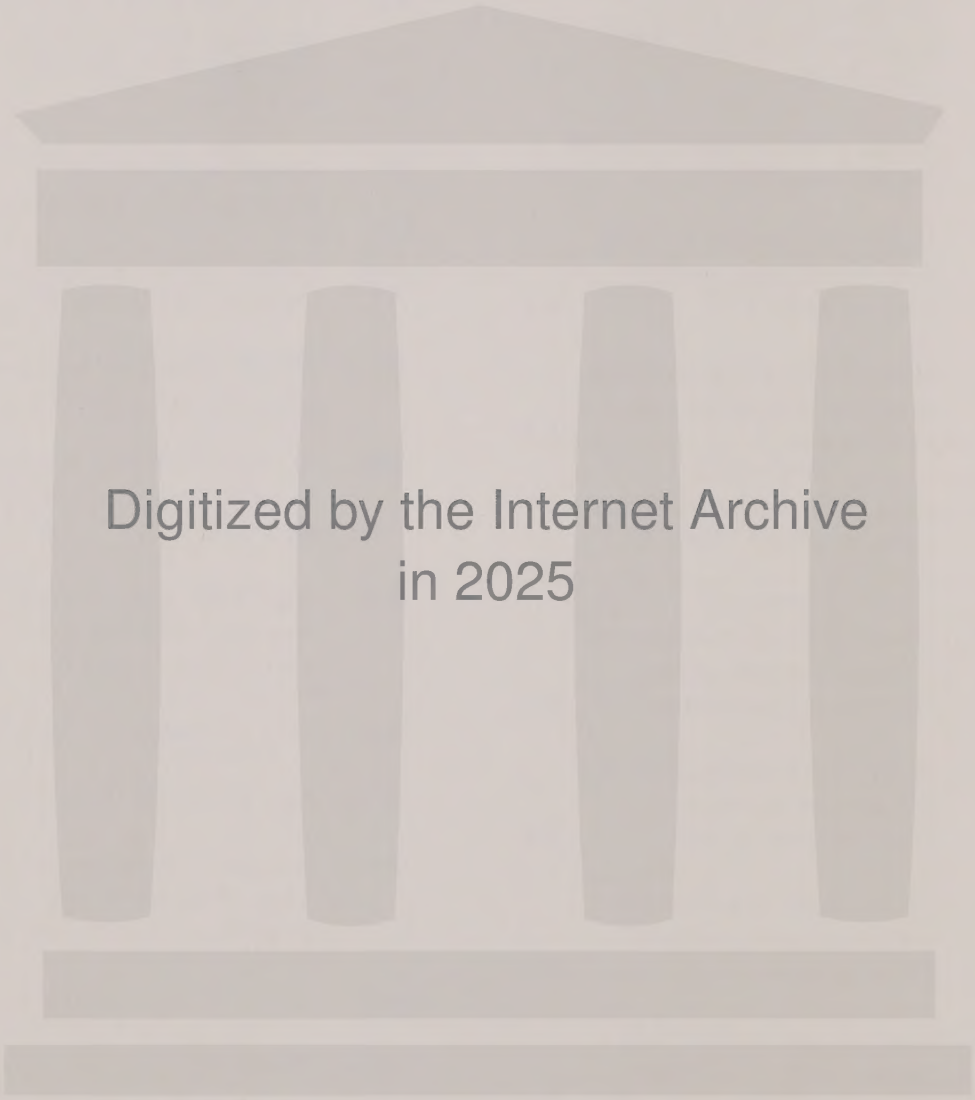
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SECTION 1

GENERAL DESCRIPTION

1-1. GENERAL CHARACTERISTICS.

1-2. The KIN TEL Model 114A Differential DC Amplifier incorporates a wide range of gains and a floating, differential input and output which are completely isolated from each other and from chassis ground.

1-3. The amplifier is constructed in modular form, 3 inches wide, 7-1/2 inches high, and 14-1/2 inches deep, for convenience in using singly or in families. (See Figure 1-1.) Each amplifier weighs 11 pounds.

1-4. Long component life with a minimum of maintenance, as well as freedom from microphonics, has been assured by use of transistors. The only two vacuum tubes employed are in the high-impedance sections of the output amplifier circuit. Input and output circuits incorporate separate chopper amplifiers. This feature provides the high stability for which KIN TEL amplifiers are noted. Matched balanced transistor demodulators (one in the output and one in the feedback circuit) provide excellent stability and linearity with maximum isolation between input and output.

1-5. An extremely low effective input capacity allows the Model 114A to be operated with either balanced or greatly unbalanced transducers and other input circuitry. This feature, due to the fact that input circuit, output circuit, and amplifier chassis may be grounded at separate points, eliminates the masking of low-level input signals by the large AC hum or noise signals which usually appear in grounding systems, especially where lengthy cabling must be employed.

1-6. APPLICATIONS

1-7. The KIN TEL Model 114A DC Differential Amplifier is designed to accept minute voltages from remotely located thermocouples, strain gages, and other electro-mechanical devices and amplify these voltages. The resultant signal may be used to drive devices with either analog or digital output.

1-8. The Model 114A allows the use of a common transducer power supply, will drive grounded, ungrounded, or balanced loads, and can be used inverting or non-inverting. It is especially designed for applications where the amplifier, transducer, and output device are grounded at different locations.

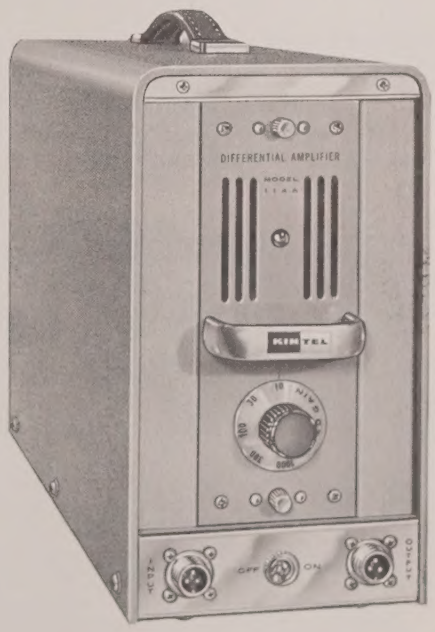


Figure 1-1. Model 114A Amplifier in Model 195 Cabinet

1-9. The KIN TEL Model 114A is ideal for multi-channel data-logging systems, and is unexcelled for amplifying small signals for application to recorders, galvanometers, and all other applicable laboratory instruments.

1-10. PACKAGING

1-11. The Model 114A is designed for use in the KIN TEL Model 195 Cabinet (See Figure 1-1) or the KIN TEL Model 190 Rack Module (See Figure 1-2).

1-12. SPECIFICATIONS.

Gain . . . . . Fixed steps of 10, 30, 100, 300 and 1000

Gain Accuracy . ± 1.0% DC to 10 cps; internally adjustable to provide a ± 2% spread simultaneously effective on all ranges

Gain Stability . ± 0.1% for 24 hours with line voltage constant within ± 2% and ambient temperature constant within ± 5° C (See Temperature Range specification)

DC Linearity . . ± 0.1% of full-scale output (10V) with load impedance of 1000 Ω or more; for a maximum output of ± 2.0 volts, linearity is ± 0.05% of the 2-volt output

Frequency Response . . . . ± 1.0% DC to 10 cps;
± 3.0% DC to 40 cps;
less than 30% down at 100 cps

Minimum Common Mode Rejection . 160 db at DC, 120 db at 60 cps with input guard returned to common mode source and unbalance of up to 10,000Ω in series with either input lead; typically ⟩30 db minimum with 1000 Ω in series with either input

Maximum Voltage between Chassis Ground and Input: (Using Guard Shield) . . . . . Input may be floated at up to ± 250 volts DC or peak AC (Output may also be simultaneously floated at up to ± 250 volts DC or peak AC, but difference between input and output cannot exceed 250 volts)

Zero Drift . . . ± 3 μv for gains of 300 and above; ± 5 μv at gain of 100; ± 10 μv at gain of 30; ± 30 μv at gain of 10 (drift is expressed as equivalent input and will conform to stated specifications when line voltage and temperature constants are as specified) over a 40-hour period after a 30-minute warm-up

Noise (P-P Equivalent Input):

In a 3-cycle bandwidth . . ≤ 4 μv for gains of 30 and above;
≥ 8 μv for a gain of 10

In a 60-cycle bandwidth. . . ≤ 6 μv for gains of 100 and above;
≤ 10 μv for a gain of 30;
≤ 30 μv for a gain of 10

In a 1000-cycle bandwidth . . . ≤ 12 μv for gains of 100 and above;
≤ 24 μv for a gain of 30;
≤ 60 μv for a gain of 10

DC Input Resistance . . . Minimum of 5 megohms; typically 10 megohms

Signal Source Impedance . . . All specifications apply with a source impedance of 1000 Ω or less. Source impedances up to 10,000 Ω will present only slight degradation in performance, principally in bandwidth and noise

Output Impedance . . . < 2 Ω, DC to 1 KC

Capacitive Loading . . . . All specifications apply with up to 0.5 μf capacitive loading

Maximum Output Capability:

Voltage . . . ± 10 volts DC or peak AC for load impedances of 1000 Ω or greater and for frequencies up to 15 cps (See Figure 1-3)

Current . . . ± 10 milliamperes DC or peak AC for loads of 50 to 1000 Ω

Loading Effects . . . Output load variations within the stated output load specifications do not affect gain accuracy, stability or linearity (See Figure 1-3)

Temperature Range . . . . . Allowable ambient temperature range at sea-level pressure is 20° to 45° C at intake on panel. Zero Drift specifications apply for any span of 10° C within the range of 20° to 45° C, provided the rate of temperature change does not exceed 5° C per hour. The principal effect of temperature variation is a shift in DC offset. DC gain will not vary more than 0.2% over the specified temperature range. When operating in standard KIN TEL housings at sea-level pressure, no amplifier damage will be sustained in ambient temperatures up to 55° C

Power Requirements:

General . . Operating voltages are internally supplied by a self-contained power supply. Nominal power requirements are given, but all specifications apply over the voltage range of 105 to 125 volts, 50 to 60 cycles, provided the line voltage does not vary more rapidly than ± 1% per minute. Line-voltage variation over the specified range will not effect a change in DC gain exceeding 0.1% on any range

*Model 114A Amplifier . . 115 volts, 60 cycles, approximately 15 watts

*Model 195 Cabinet (with fan)
(For single Model 114A Amplifier)115 volts, 60 cycles, 15 VA

*Model 190 Rack-Module (with 3 fans)
(For 6 Model 114A Amplifiers). . .115 volts, 60 cycles, 45 VA

Dimensions:

*Model 114A Amplifier. . 2-7/8" wide, 7-5/8" high, 14-5/8" deep

*Model 195 Cabinet . . . 5-7/16" wide, 10" high, 18-1/4" deep

*Model 190 Module . . . 19" wide, 8-3/4" high, 18-1/4" deep

Weights:

(In Pounds)	NET	SHIPPING
*Model 114A Amplifier	11	20
*Model 195 Cabinet	13	20
*Model 190 Module	34	50

*Amplifiers must be used with either Model 195 Cabinets or Model 190 Modules.

Specifications subject to change without notice.

Figure 1-2. Model 190 Module With Five Model 114A Amplifiers and One Model 114FP Filler Panel

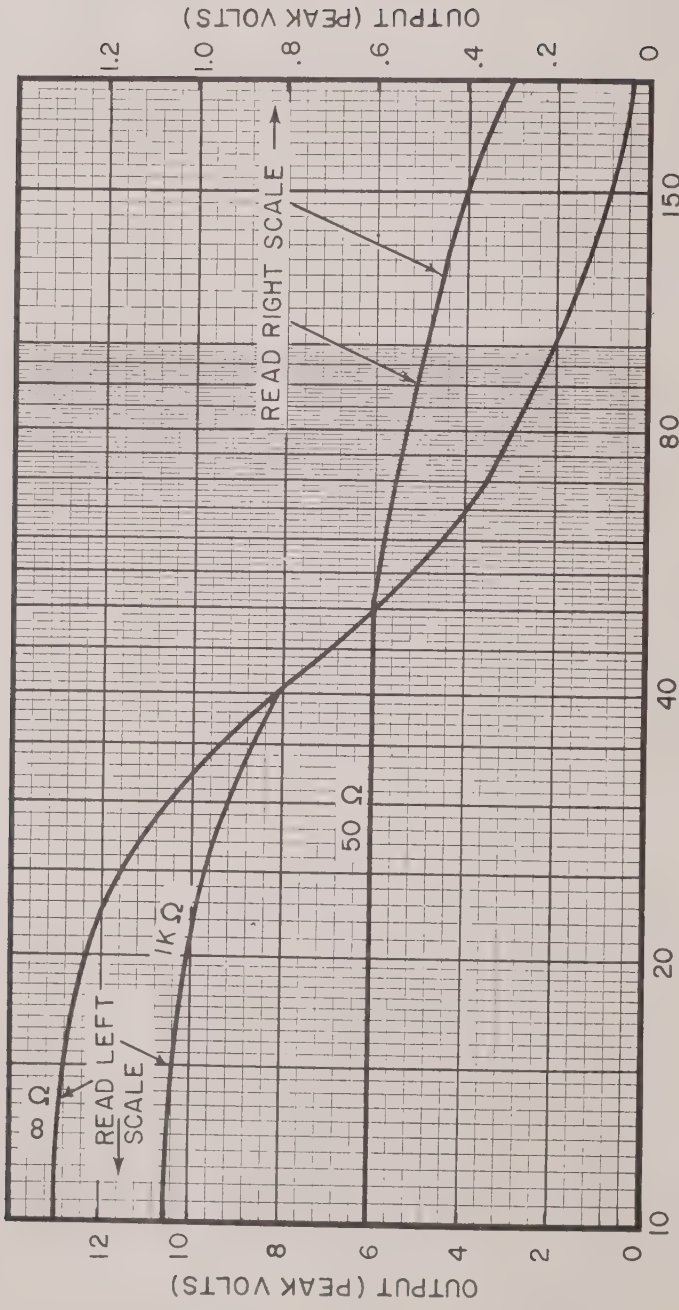


Figure 1-3. Model 114A Maximum Output versus Frequency (115-volt line)

Section II

OPERATION

2-1. UNPACKING.

2-2. As soon as the Model 114A is received, it should be unpacked and examined for damage which may have occurred in shipment. Should any damage be found, immediate claim should be filed with the carrier, stating the extent of damage.

2-3. INSTALLATION.

2-4. KIN TEL Model 114A DC Differential Amplifiers must be installed in either the KIN TEL Model 190 rack adaptor module or the Model 195 cabinet. *

2-5. MODEL 190 MODULE. The Model 190 module (see Figure 2-1) accepts up to six Model 114A amplifiers. A connector on the rear of the amplifier mates with a connector inside the module. This plug-in feature allows easy removal and replacement of amplifiers. An AC line cord on the rear of the module provides power for the fans and is pre-wired to the connectors to provide power for the amplifiers. Wiring of input and output signal leads and shields is accomplished by soldering the leads directly on the connectors at the rear of the module. To obtain access to these connectors, the panel on the lower rear of the module must be removed. Input and output cabling for the module may be threaded through grommets on either side of the module.

2-6. The functions of the various pin connections on the Model 114A are as follows:

INPUT CIRCUIT	
High-signal lead	pin 12
Low-signal lead	pin 11
Shield (or guard)	Connector ring
OUTPUT CIRCUIT	
High-signal lead	pin 9
Low-signal lead	pin 7
Shield (or guard)	pin 5
CHASSIS GROUND	pin 4

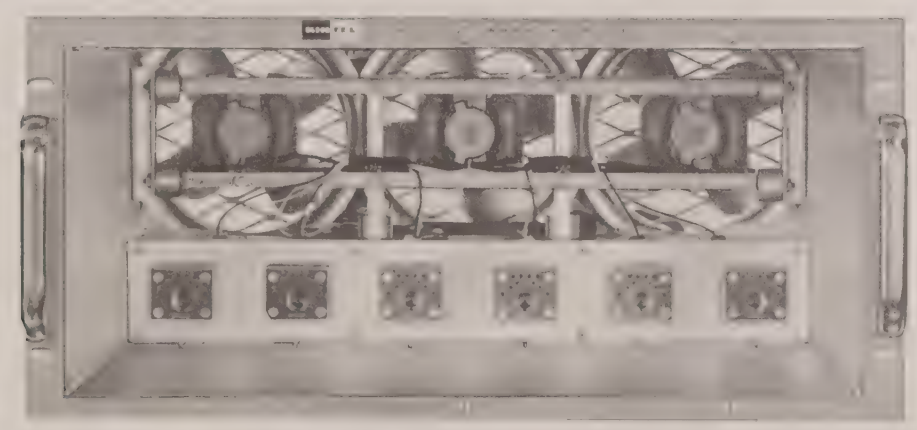


Figure 2-1. Model 190 Module Showing Amplifier Connectors and Cooling Fans

*The Model 190 Module and Model 195 Cabinet also accept KIN TEL Series 111 DC Amplifiers.

AC LINE	pins 8 and 10
NOT USED	1, 2, 3, and 6

2-7. MODEL 195 CABINET. The Model 195 cabinet (see Figure 2-2) accepts a single Model 114A amplifier which plugs into a mating connector in the rear of the cabinet. The cabinet contains an AC on-off switch, a fan, a line fuse and a line cord. Input and output connections to the amplifier are brought out to the connectors on the front of the cabinet. Figure 2-3 shows how the pin connections on the amplifier are connected to the input and output connectors on the cabinet. Wiring continuity of the cabinet is accomplished by soldering input and output signal and shield leads to the mating connectors supplied with each cabinet.

2-8. GROUNDING CONSIDERATIONS. As stated in paragraph 1-8 of this manual, the Model 114A features characteristics of design which recommend it for systems utilizing various grounding methods. The following paragraphs and accompanying illustrations clarify the most commonly used system-grounding procedures.

2-9. GROUNDED SOURCE-GROUNDED LOAD. In a grounded-source grounded-load system such as shown in Figure 2-4, the input shield should be connected to one side of the input-signal leads at the signal source. If an input unbalance greater than 1000 ohms is present, an approximate 6 db improvement in common-mode rejection may be obtained by connecting the input shield to the low side (pin 11) of the input-signal leads at the signal source. The significance of this improvement is not great enough to preclude the choice of connecting the input shield to the high side (pin 12) of the input-signal leads and thereby inverting the phase of the input signal if desired. The output shield should be connected to the low side (pin 7) of the output-signal leads at the load end. All input and output cables should be of the shielded twisted-pair type, with an outer, insulating jacket. Note that only one ground exists for the output-signal leads and output shield.

2-10. FLOATING SOURCE-FLOATING LOAD. Figure 2-5 shows the Model 114A connected to an ungrounded source and

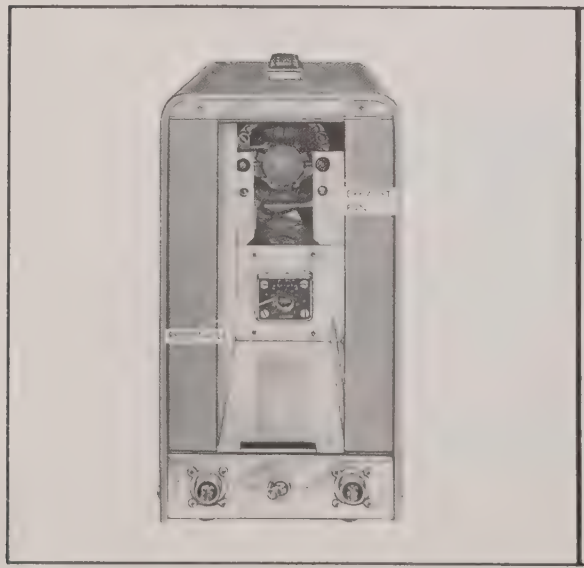


Figure 2-2. Model 195 Cabinet Showing Amplifier Connector and Cooling Fan

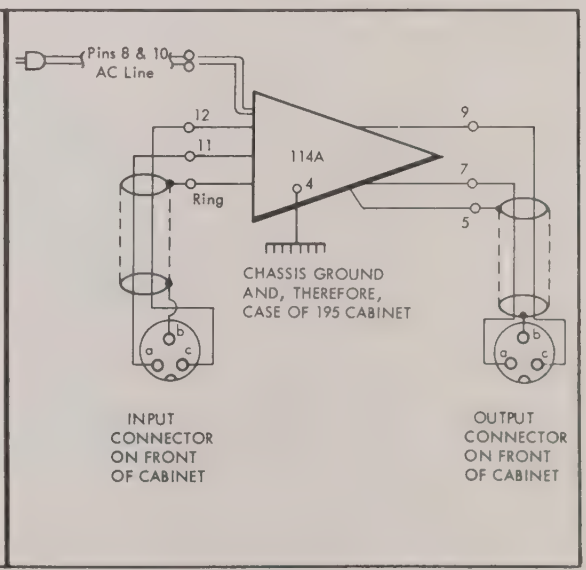


Figure 2-3. Model 195 Cabinet Connections for Model 114A Amplifier

ungrounded load.

2-11. FLOATING SOURCE-GROUNDED LOAD OR GROUNDED SOURCE-FLOATING LOAD. Figures 2-4 and 2-5 can be combined to show how the connections for grounded load and floating source (or floating load and grounded source) are made.

2-12. MULTI-CHANNEL STRAIN-GAGE SYSTEMS. Figure 2-6 illustrates proper connections to Model 114A amplifiers and single power supply for a multi-channel strain-gage system.

2-13. Where any length of cable is involved, best performance is obtained by connecting the signal source and load to the Model 114A as shown in Figure 2-4. This is true even if the signal source or the load (or both) are floating rather than grounded. Figure 2-5 illustrates connections which would normally work well only under test conditions where signal source, amplifier, and load are all close together.

2-14. OPERATION.

2-15. Amplifiers installed in the Model 195 cabinets are powered through an AC on-off switch; installations using the Model 190 module have no switching facilities, and amplifiers in the module are powered when the AC line cord is connected to a nominal 117-volt AC source.

2-16. When the amplifier is turned on, the pilot lamp will light. For minimum drift and offset, allow a period of ten to thirty minutes for warm-up before operation. The desired gain is set by means of the gain switch on the front panel.

2-17. ADJUSTMENTS. Each Model 114A Amplifier is adjusted under rigid test conditions at the factory, at which time potentiometer R418 is adjusted for zero output with zero input on the X10 range. Note that R418 is used for zeroing the output circuit only. This should not be used as a zero control for the entire instrument. Note also that if R418 is adjusted too far from its correct setting, a resulting increase in the 60-cycle hum in the output amplifier will consequently raise the noise level of the instrument. In general, the only reason for field adjustment of R418 would be the aging or replacement of tubes or chopper in the output amplifier.

2-18. FRONT PANEL ZERO CONTROL. Starting with serial number 1101, Model 114A amplifiers have been provided with a front-panel control for zero adjustment. This screwdriver-adjustable pot (R903), which acquires positive and negative voltages from Zener diode references,

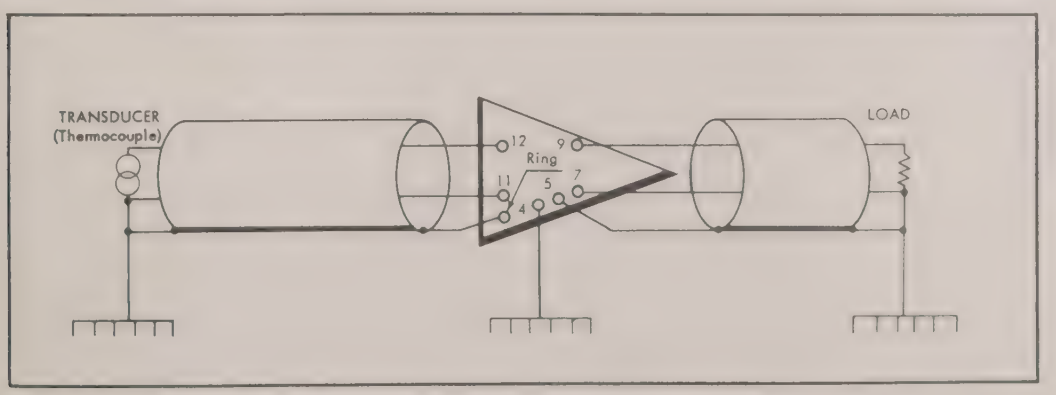


Figure 2-4. Model 114A Connections for a Grounded-Transducer/Grounded-Load System

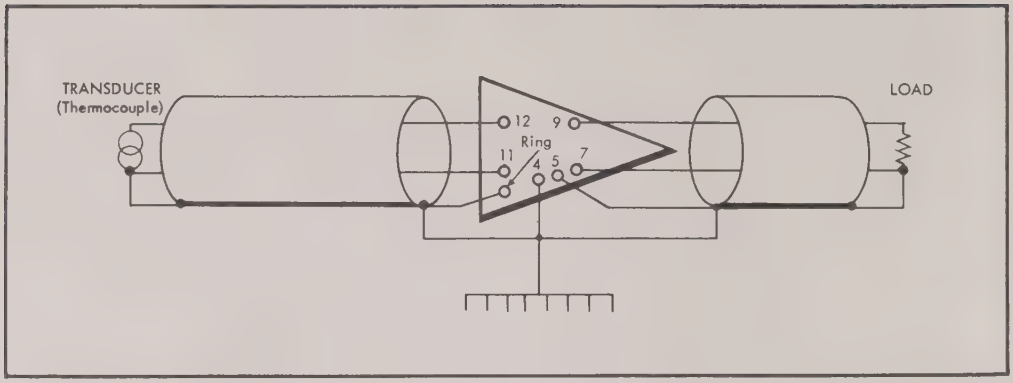


Figure 2-5. Model 114A Connections for a Floating-Transducer/Floating-Load System

applies a controlling voltage to the input of the output amplifier in a manner which compensates for any internal offsets introduced on any gain range. The adjustable range of the zero control is more than adequate to bring overall output of the Model 114A to zero offset.

2-19. The zero control is not intended as a wide-range control for line unbalance or as a zero-suppression device. Its range provides compensation for any reasonable offset inherent in the amplifier itself, with further capability of compensation for a few additional microvolts of unbalance which may be introduced from another source.

2-20. If it becomes advisable to readjust the zero control, it is generally better to make this adjustment on the higher gain ranges where there may be some offset, although this usually amounts to less than the equivalent-input drift. For further details, refer to the Test Procedure manual for the Model 114A (Code No. 2X-45).

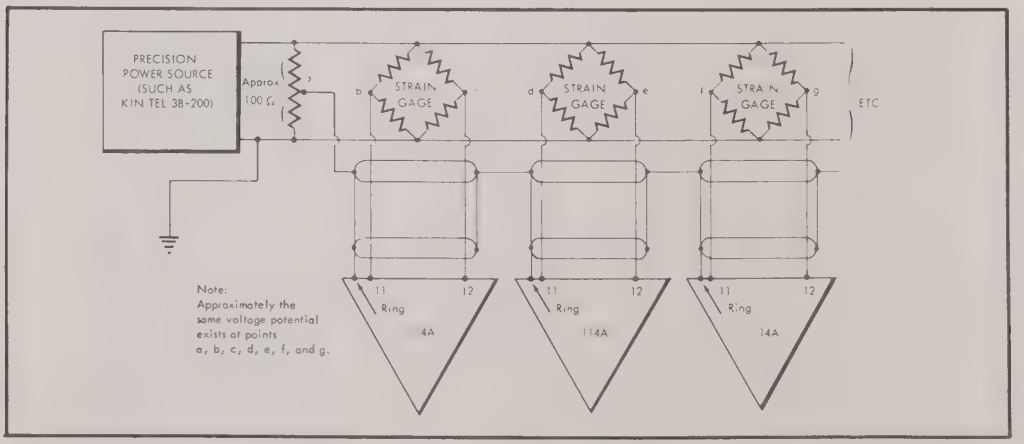


Figure 2-6. Model 114A Amplifiers in a Multi-Channel Strain-Gage System

Section III

CIRCUIT DESCRIPTION AND THEORY

3-1. DEFINITION OF TERMS.

3-2. As used throughout this manual, the term "common-mode voltage" is defined as a voltage which appears between both input terminals (in common) and the low side of the output terminals. It is abbreviated CMV or, for mathematical purposes, E_{cm}. This common-mode voltage may consist of DC and AC components.

3-3. The term "common-mode rejection" is defined as the ability of a differential amplifier to provide an output voltage independent of the common-mode signal, and is equal to the ratio of the input common-mode voltage to the equivalent differential input it causes. It is abbreviated CMR.

3-4. The differential signal, or that signal which is not common to both input terminals of a differential amplifier, is usually termed "normal-mode signal" and is abbreviated as NMS. It is usually expressed mathematically as e_{input} or simply e_{in}.

3-5. By "equivalent differential input" is meant the result of the computation

$$\frac{E_r}{G}$$

where G = the amplifier gain setting and

E_r = the amplifier-output signal resulting from the CMV applied to the amplifier input.

3-6. COMMON-MODE REJECTION.

3-7. The capability of an amplifier to reject common-mode voltages is stated as a ratio of the common-mode voltage to the equivalent differential input which is caused as a result of the common-mode voltage. The rejection capability of an amplifier may be determined by the equation

$$CMR = \frac{G\,E_{cm}}{E_r}$$

where G = gain of the amplifier and

E_r = the amplifier-output signal resulting from the E_{cm} applied to the amplifier input.

3-8. FUNCTION OF A DIFFERENTIAL AMPLIFIER.

3-9. The primary function of a differential amplifier (beyond the functions of a single-ended amplifier) is to effect a separation of input and output circuits. The so-called balanced amplifier (often called a symmetrical amplifier) may achieve some common-mode rejection as a result of balancing, but does not in fact separate input from output circuits. Since such amplifiers may have common connections (through the common line of the amplifier or through feedback circuits) common-mode rejection is restricted for all practical purposes. The Model 114A provides such a large common-mode rejection that it is ideally suited for all applications where common-mode rejection is required.

3-10. BLOCK DIAGRAM OF THE SYSTEM.

3-11. Figure 3-1 is a block diagram of the Model 114A. It has been inserted at a point which allows its use throughout this manual section devoted to circuit description. The schematic diagram at the extreme back of the manual may also be unfolded should certain circuit details be pertinent to an understanding of the system.

3-12. 880-CYCLE OSCILLATOR.

3-13. The 880-cycle oscillator is not a sine-wave oscillator, but a pulse generator having a repetition rate of approximately 880 pulses per second.

3-14. 2:1 BINARIES.

3-15. Two separate 2:1 Binary circuits provide separate symmetrical square-waves to drive the input chopper and the two demodulators.

3-16. PHASE SYNC.

3-17. The phase-sync circuit is provided to interlock the two binaries in a manner which will assure constant relative phase between the respective driven circuits.

3-18. DELAY CIRCUIT.

3-19. The delay circuit is actually a one-shot multivibrator which receives the 880-cycle signal from the oscillator and produces a controlled pulse which keys the second binary (the one furnishing the demodulator-drive signal).

3-20. DRIVERS.

3-21. The driver stages are actually double emitter-follower stages which apply the binary-signals to their respective points (demodulator drive and input-chopper drive).

3-22. INPUT-AND-FEEDBACK FILTER.

3-23. The input filter attenuates unwanted signals above the required overall pass-band. The feedback filter provides amplifier stability by determining the amplitude and phase responses (vs frequency) for the feedback loop.

3-24. FEEDBACK GAIN SET.

3-25. The feedback gain set attenuates feedback in the carrier amplifier to determine overall gain of the Model 114A.

3-26. INPUT CHOPPER.

3-27. The input chopper samples the input DC signal each half cycle, converting it effectively to a proportional AC, using a carrier frequency of 440 cycles.

3-28. INPUT CHOPPER AMPLIFIER (CARRIER AMPLIFIER).

3-29. The input-chopper amplifier or carrier amplifier is a narrow band, high gain, transformer coupled stage which amplifies the chopped input and applies the resulting signal to the demodulator signal transformer.

3-30. BALANCED FEEDBACK DEMODULATOR.

3-31. The feedback demodulator derives from the input chopper amplifier a transformer-coupled signal which is demodulated and routed to the input of the 114A.

3-32. BALANCED OUTPUT DEMODULATOR.

3-33. The output demodulator serves to demodulate the transformer-coupled signal from the input-chopper amplifier; this signal is applied to the filter and limiter network in the output stages.

3-34. OUTPUT FILTER AND LIMITER.

3-35. The output filter aids in determining output-amplifier characteristics and is the reciprocal of the filter used in the input circuit. The limiter consists of back-biased silicon diodes which limit the maximum voltage applied to the input of the output amplifier.

3-36. OUTPUT-CHOPPER AMPLIFIER.

3-37. The output-chopper amplifier provides a path for DC and low-frequency signals derived from the filter and limiter; the resultant amplified signal is applied to the output DC amplifier.

3-38. WIDEBAND AMPLIFIER.

3-39. The wideband amplifier provides a high-frequency (i.e., above a few cps) path parallel to the chopper amplifier.

3-40. The combined capabilities of the output-chopper amplifier and the wide-band amplifier insure gain from DC to high frequencies.

3-41. DC AMPLIFIER.

3-42. The output DC amplifier receives the summed signals from the output-chopper amplifier and the wideband amplifier and applies the resulting signal (after a final amplification) to the output-signal terminals.

3-43. FEEDBACK NETWORK.

3-44. The feedback network in the output circuit consists of resistors which set the DC gain and a capacitor which establishes a low-frequency corner.

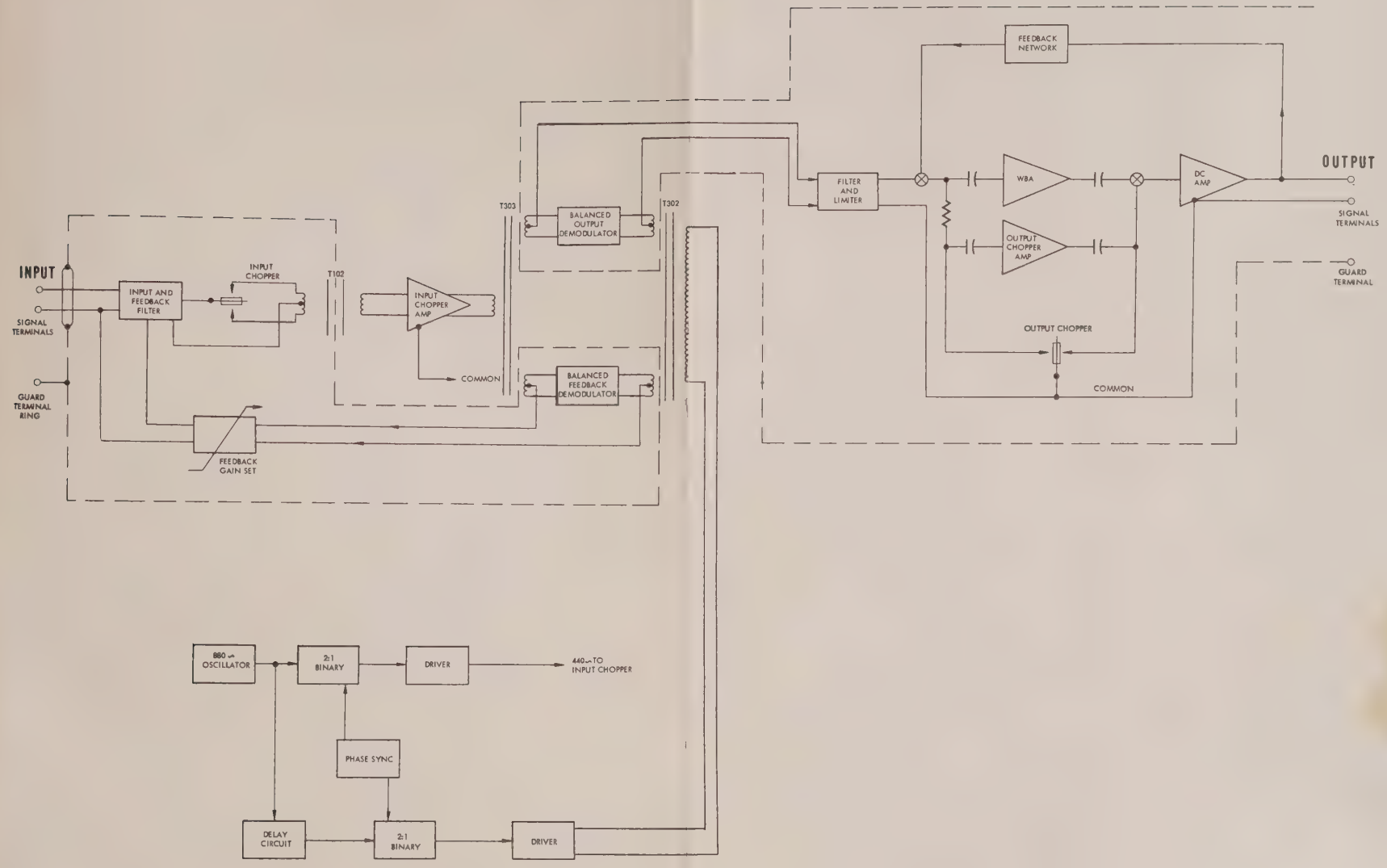


Figure 3-1 (Revised). Block Diagram of KIN TEL Model 114A DC Differential Amplifier

Section IV

MAINTENANCE

4-1. HANDLING PRECAUTIONS.

4-2. ETCHED AND PRINTED CIRCUIT BOARDS. Every precaution should be taken in handling etched and printed circuitry while servicing. Boards may be contaminated by salts and acids present in the human skin. Such contamination can lower leakage resistance between paths or components mounted on the boards. It is advisable to wear clean, cotton gloves when it becomes necessary to handle such circuitry.

4-3. PHYSICAL SHOCK. Although the Model 114A is essentially a very rugged instrument, it may be subject to damage if given a severe shock, especially such as may be occasioned by delivering sharp, lateral blows to the input plate. The combined weight of transformer, chopper and filter is adequately supported by mounting posts which are necessarily made of dielectric materials and, therefore, less shockproof than steel. A sudden lateral blow such as might be occasioned by slamming the amplifier down on its side or end might shear these posts, even though vertical shocks or pressure blows might be sustained without incident.

4-4. PREVENTIVE MAINTENANCE.

4-5. TUBES AND CHOPPERS. Quite logically, the most frequent sources of trouble in the Model 114A are tubes and choppers. Therefore, any preventive maintenance program should include a periodic check of these components. For replacement information, refer to paragraphs 4-9 through 4-12.

4-6. FAN MOTORS AND GRILLES. Model 114A amplifiers are housed in racks or hand-carry cabinets which provide forced-air cooling. If the installation area is air conditioned, dust and lint pollution will be minimal and cleaning of grilles and modules should be scheduled after each approximate 2000 hours of operation. The optimum time schedule for cleaning should actually be determined by visual inspection.

4-7. Lubrication of fan motors should be performed in conjunction with cleaning operations. It is extremely important that the proper lubricant (Shell Oil No. 933, Code L-297) be used on these motors. Since the bearings are of a porous material to regulate oil flow to the motor shaft, oils having a lacquer base may, in the presence of heat generated by motor operation, cause bearing pores to clog. Clogged bearings will necessarily reduce speed and may lead to intermittent operation or even progress to a state of complete inoperation. Since amplifier stability may be impaired by improper ventilation, the motor assembly must be completely cleaned to restore original operating conditions. Refer to paragraphs 4-17 through 4-22 for detailed procedure.

4-8. CORRECTIVE MAINTENANCE.

4-9. VACUUM TUBES. The only vacuum tubes employed in the Model 114A are not critical and may be replaced with no regard to selectivity, providing replacements are of standard EIA quality.

4-10. CHOPPERS. The choppers used in the Model 114A may be considered to be nonselective, if it is understood that any change in choppers may require the readjustment of R418 (the internal-balance pot in the output circuit).

4-11. The input chopper is a Bristol unit

which features an interchangeable drive coil. Although the manufacturer's designation for the particular coil used in the Model 114A is "60-cycle," it is pointed out that in this application, the drive is actually an approximate 440 cps. Therefore, this coil should be ordered by KIN TEL part number from KIN TEL or, if ordered by Bristol part number, by the additional 60-cycle description.

4-12. Because this chopper features minimum coupling between drive-coil and stack (less than 0.01 μμf) and a removable shield which further isolates the hermetically sealed unit, THE USE OF ANY OTHER THAN THE RECOMMENDED REPLACEMENT FOR THE INPUT CHOPPER WILL VOID THE AMPLIFIER'S COMMON-MODE REJECTION WARRANTY!

4-13. TRANSISTORS. Only two of the several types of transistors used in the Model 114A are selective. The 2N175 (Q318) is slightly critical in that an occasional unit may be found which is too noisy to meet the noise specifications of the amplifier.

4-14. The GT75X (Q306 through Q313) is actually a highly rated, hand-selected GT75. These are sorted and color coded according to gain, leakage current and linearity over a range of temperatures. It is important that all transistors in the demodulators have matching characteristics, and the adoption of color coding has simplified this selection in the field. The KIN TEL part number for the GT75X transistor bears a dash-number or suffix to identify its color code, so that one only need order the proper color by number to achieve an exact replacement for damaged transistors. In the case of early production models, in which no color coding was used, the replacement of any transistor in the demodulators should indicate that all eight be replaced. This will achieve the installation of an established common color and insure that subsequent replacements need only involve individual transistors if the color code is followed.

4-15. The GT35 transistor (Q304, Q314, Q316, Q317, Q319), as used in the Model 114A, cannot be said to be selective; however, it should be noted that the manufacturer of the GT35 cross-lists this unit with a 2N35. A stock commercial 2N35 may not hold up in this application, although the GT35 not only meets all of the EIA requirements for the 2N35, but has an additional heat dissipation rating which is advantageous to this application. Since all GT35 transistors have been found to meet requirements of this circuitry, the unit cannot be said to be selective, but substitution of any cross-referenced unit classed as nominally equivalent may result in less than optimum performance.

CAUTION

A common cause of trouble in transistorized circuitry is the erroneous insertion of transistors in sockets (i.e., inserting a transistor in a socket wired for another type, inserting the leads in wrong socket-holes, or allowing a lead to bend and enter no socket-hole at all.

4-16. DIODES. Although it is highly unlikely that diodes used in the Model 114A will fail, there exists the possibility of accidental breakage or overheating from soldering tools. The only diodes which are at all selective are CR501 and CR502. These are 1N625 silicon diodes which are specially selected for low-leakage impedance, and should be replaced only by diodes selected by KIN TEL and stocked under the specific KIN TEL part number.

4-17. FAN-MOTORS. As mentioned in paragraph 4-6, improper lubricants can clog fan bearings and result in one of several conditions requiring cleaning of the

mechanism. If this becomes necessary, the motor should be removed from the cabinet or rack and disassembled as shown in the exploded view in Figure 4-1.

4-18. After the motor is disassembled, the bearings may be cleaned by lightly scraping the surfaces of each bearing to remove any hardened deposits and then soaking the entire bearing assembly in a solvent for at least four hours. A stiff brush dipped in the solvent may aid in removing deposits from the rotor shaft.

4-19. When soaking has sufficiently removed deposits on the bearings, wipe all surfaces dry with a clean lint-free cloth. Ascertain that there is no deposit remaining before beginning the lubrication procedure.

4-20. After bearings are clean and dry, place the assembly in an oil bath, using only the recommended lubricant (Shell Oil No. 933, Code L-297). Soak in the oil bath for two hours, remove from bath, and wipe off excess oil. The motor may then be reassembled, again using the exploded view in Figure 4-1 as a guide.

4-21. Care should be used in aligning the motor shaft and bearings before the four frame bolts are tightened. Since the bearings are semi-floating, no difficulty should be experienced in assembling them properly.

4-22. Subsequent oiling should occur at regular intervals, length of which should be determined as stated in paragraphs 4-6 and 4-7. Frequent removal of accumulated dust from the motor by means of compressed air is recommended; however, amplifiers should be unplugged and removed from the area of contamination before such blowing operations are performed.

4-23. PARTS LOCATION.

4-24. Figures 4-2 through 4-8 illustrate subassemblies and views of the final assembly including parts callouts. For servicing convenience, some parts-location photos are shown as seen from the etched-path side of a board in cases where the servicing will be done largely from that side of the board.

4-25. External parts are shown in photographs of the amplifiers mounted in Model 190 and 195 cabinets. (See Figures 4-9 and 4-10.)

4-26. MISCELLANEOUS SERVICE DATA.

4-27. WAVEFORMS. Table 4-1 presents waveforms found at pertinent points in the circuitry of the Model 114A.

4-28. VOLTAGES. Pertinent voltages are shown on the schematic diagram, Figure 4-11.

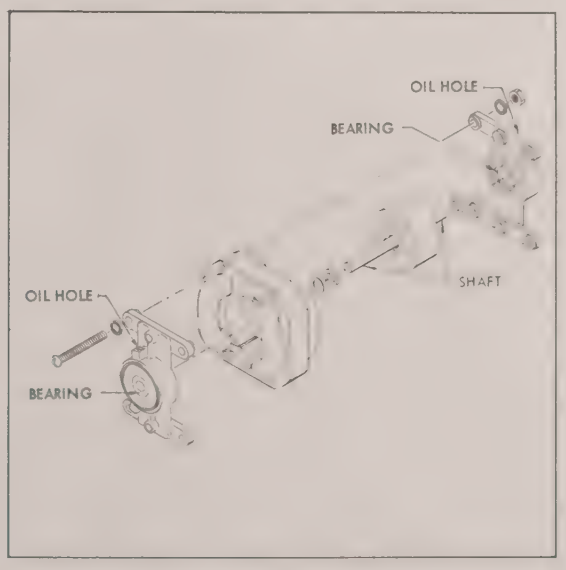


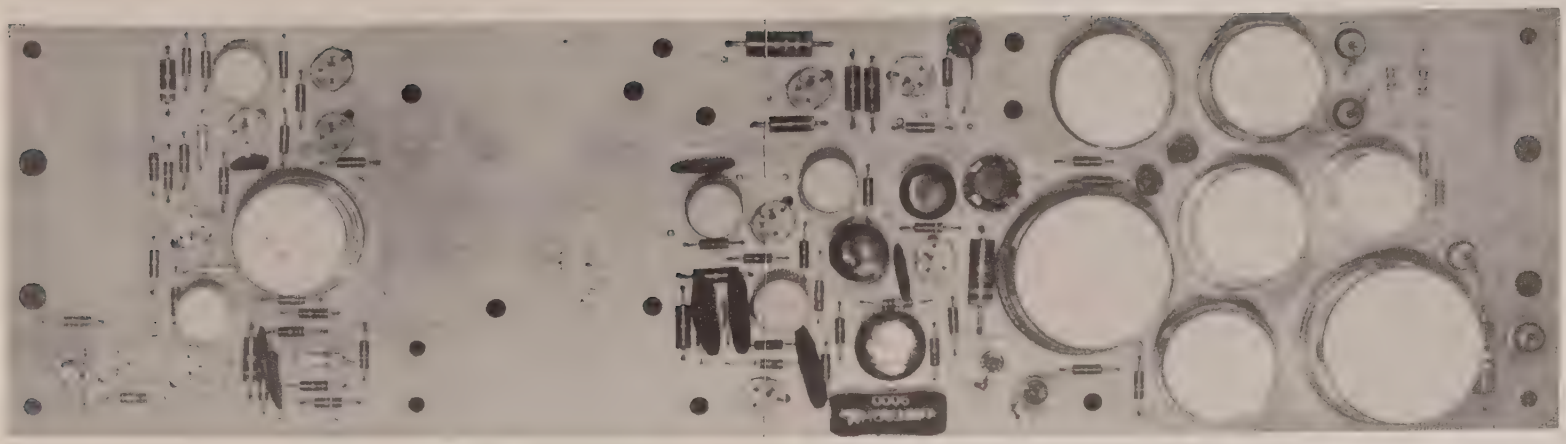
Figure 4-1. Exploded View of Fan Motor Assembly

4-29. RECOMMENDED SPECIAL TEST EQUIPMENT. To insure accurate testing of the Model 114A, the KIN TEL Model 114T Test Bridge should be used. This unit provides test facilities specifically designed to the accuracies necessary for the precision testing of these amplifiers. Adequate procedure information for the use of the Model 114T will be found in the technical manual for the unit, and additional data will be available in the manual designated as Test Procedure for the Model 114A DC Differential Amplifier (Code No. 2X-45).

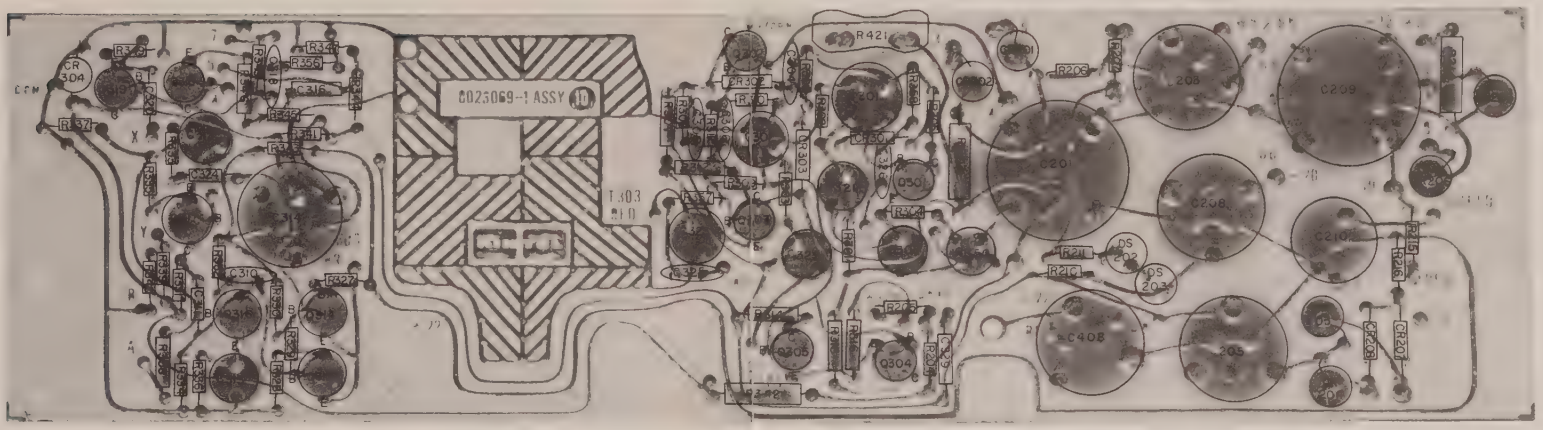
4-30. Other test equipment recommended for testing the Model 114A will include such items as the KIN TEL Model 202B Microvoltmeter or the Model 203AR Microvolt-Ammeter and Amplifier or equivalent, and the Tektronix Model 535 Oscilloscope or equivalent. A complete list of necessary equipment will be found in the Test Procedure manual.

4-31. PARTS LIST. Table 4-2 lists the replaceable parts of the Model 114A DC Differential Amplifier.

4-32. SCHEMATIC DIAGRAM. Figure 4-11 shows the schematic diagram of the Model 114A DC Differential Amplifier.

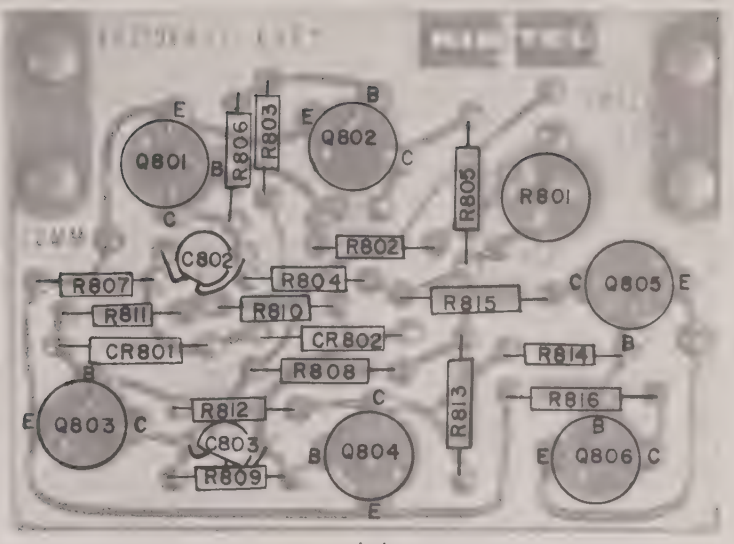


Top view, showing mounting of components

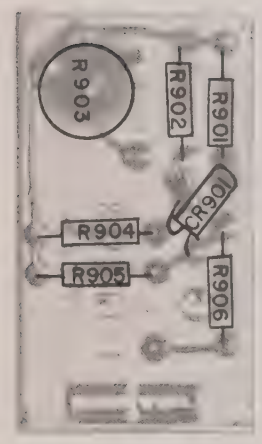


Bottom view, showing etched paths with component location

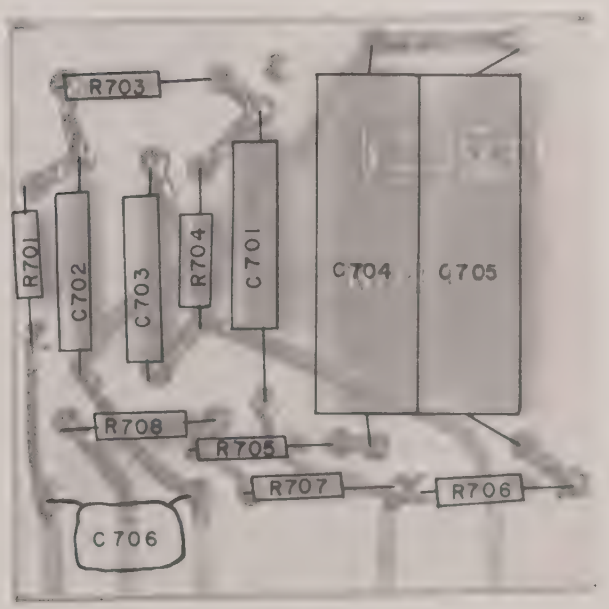
Figure 4-2. Main Circuit board of Model 114A Differential DC Amplifier



(A)
Demodulator Reference Board (Demodulator Delay-Line, Binary and Driver Stages)



(B)
Zero-Adjust Circuit



(C)
Input and Feedback Filter

Figure 4-3 (A-B-C)
Parts Location From Etched Side

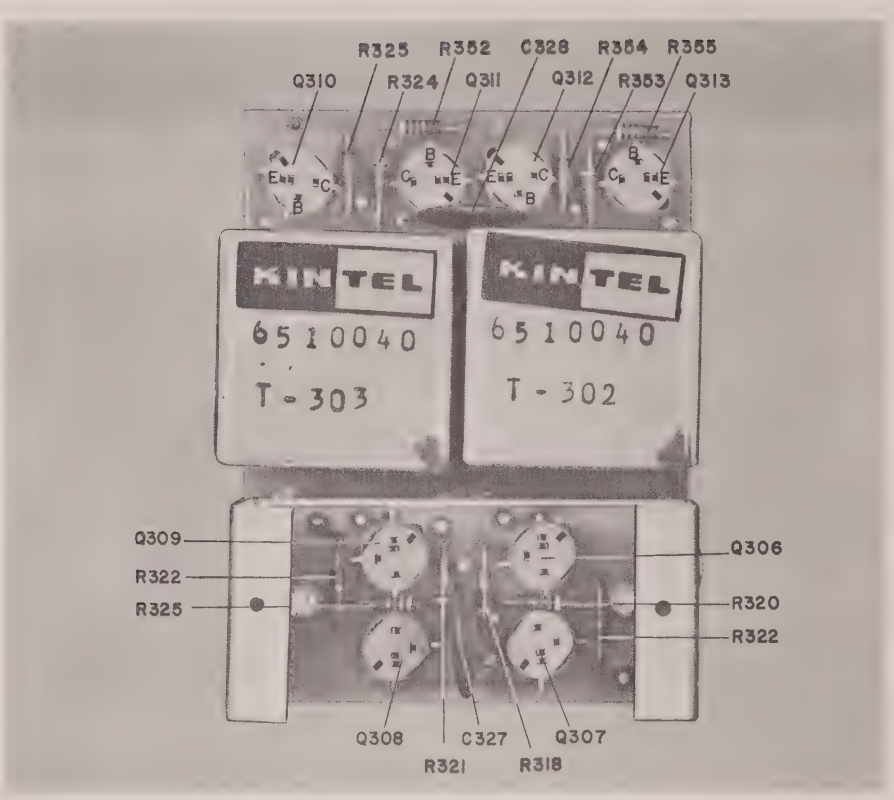


Figure 4-4. Demodulator Assembly Showing Parts Location

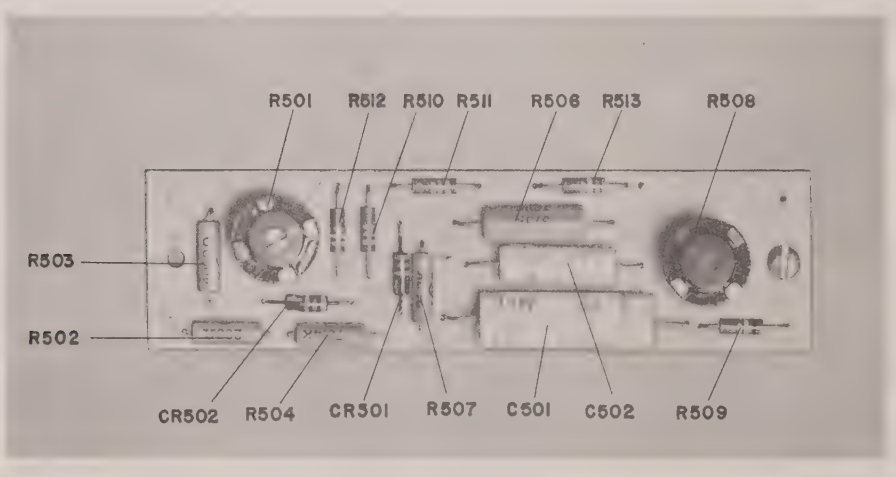


Figure 4-5. Output Filter Assembly Showing Parts Location

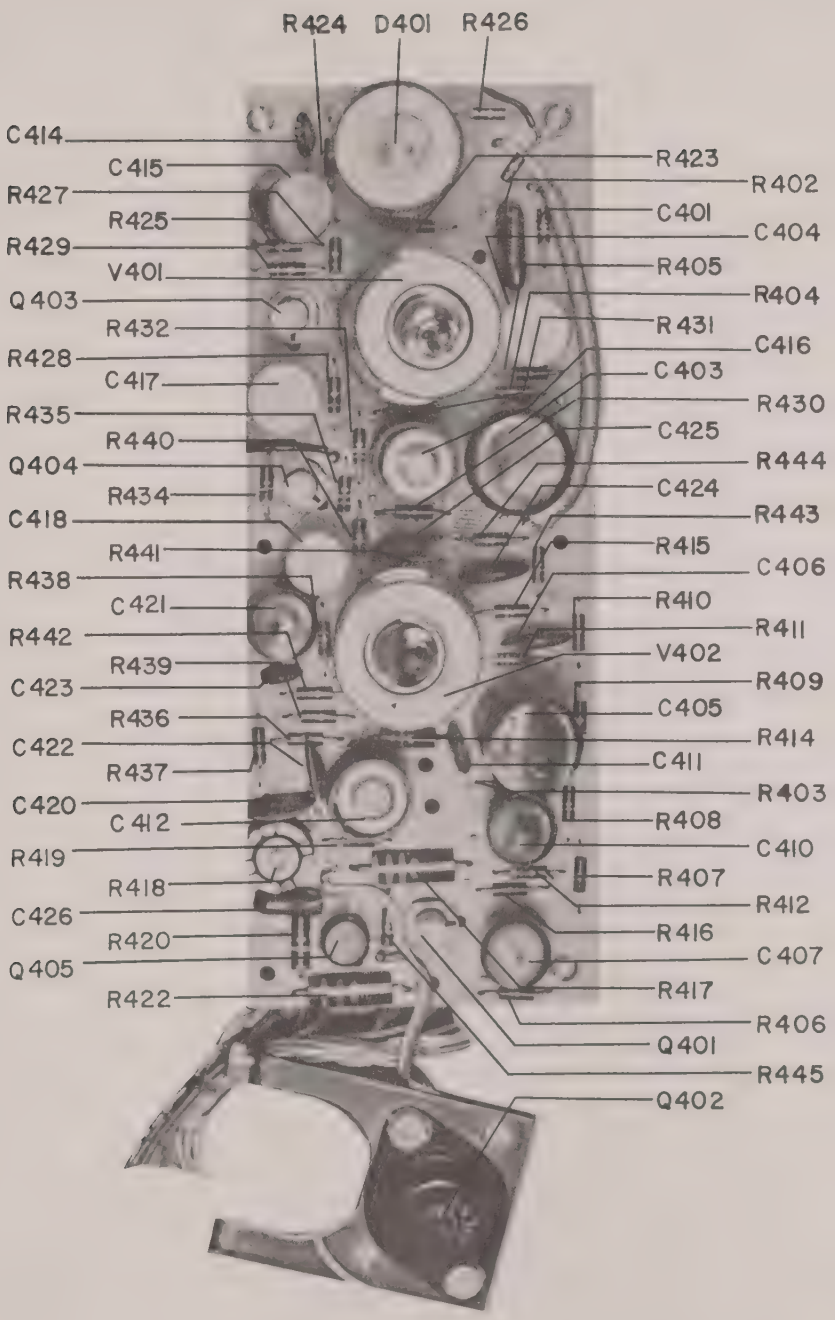


Figure 4-6. Output Amplifier Assembly Showing Parts Location

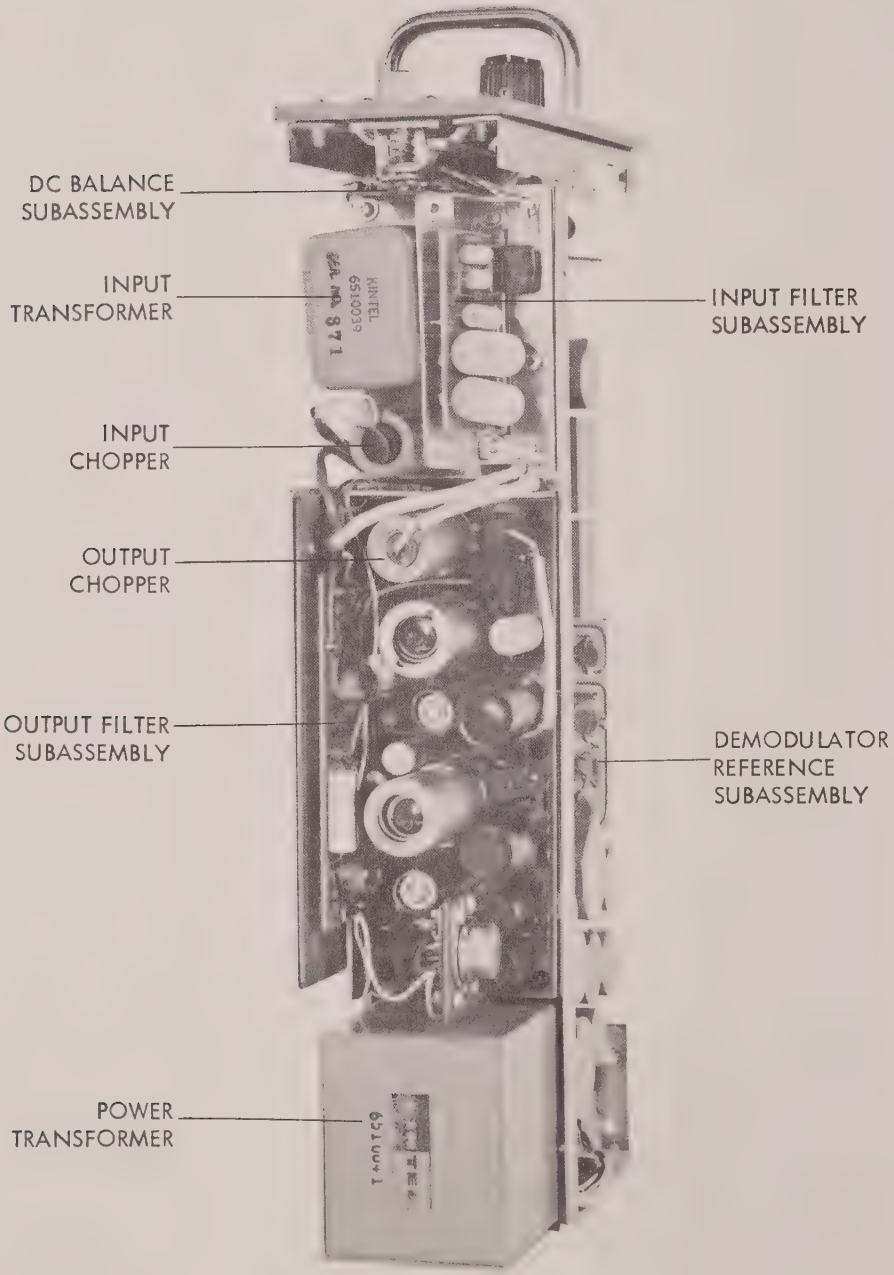


Figure 4-7. Top View of Final Assembly Showing Additional Parts Locations

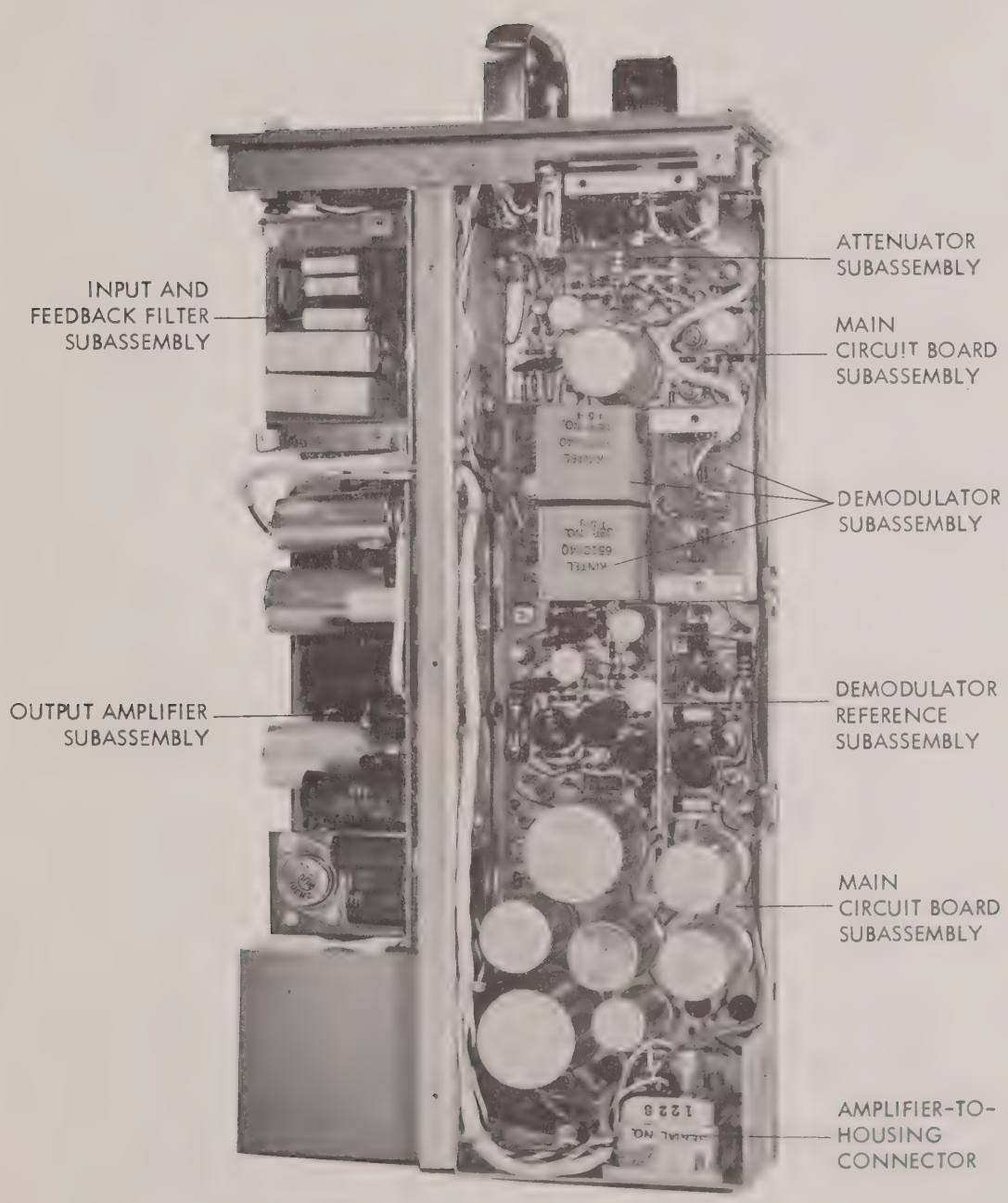


Figure 4-8. Right Side View of Final Assembly Showing Additional Parts Locations

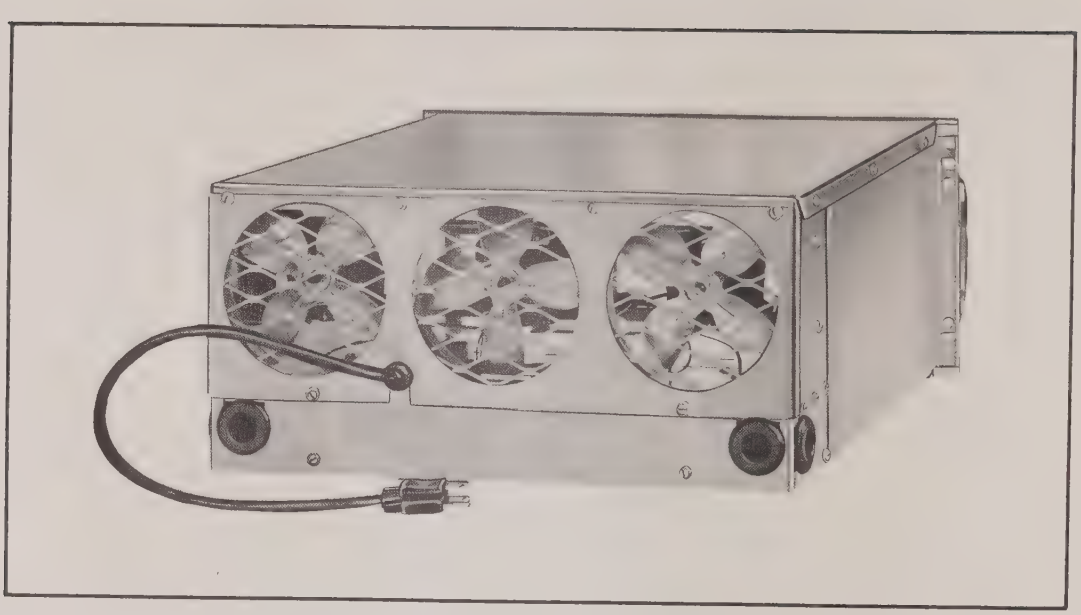
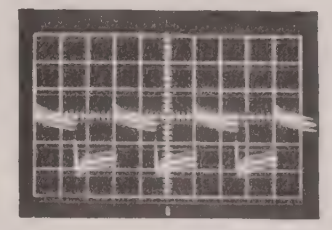


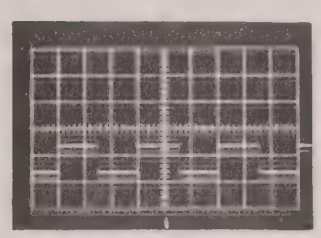
Figure 4-9. Rear of Model 190 Module

Figure 4-10. Rear of Model 195 Cabinet

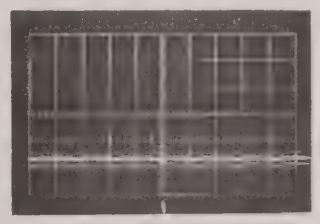
TABLE 4-1



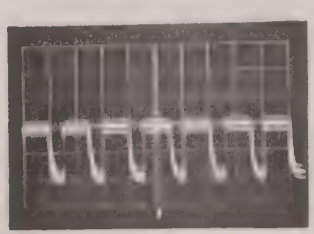
1. Yellow lead of D101 to chassis ground
SENSITIVITY: 10 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: Shorted
SCOPE INPUT SELECTOR: DC



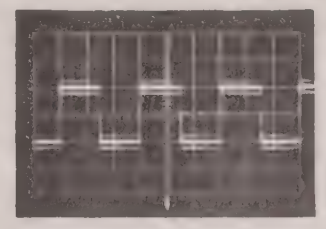
2. Pin 1 of T302 to chassis ground
SENSITIVITY: 10 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: Shorted
SCOPE INPUT SELECTOR: DC



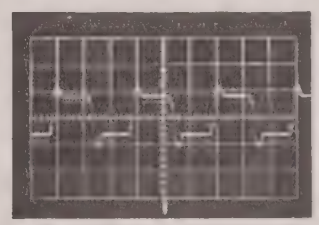
3. Pin 2 of T301 to chassis ground
SENSITIVITY: 10 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: Shorted
SCOPE INPUT SELECTOR: DC



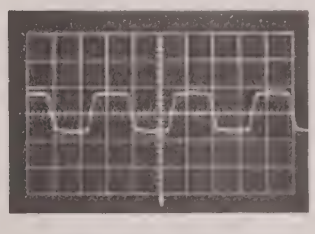
4. Collector of Q802 to chassis ground
SENSITIVITY: 10 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: Shorted
SCOPE INPUT SELECTOR: DC



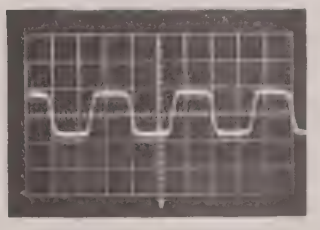
5. T302 pin 7 to T302 pin 8
SENSITIVITY: 10 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: Shorted
SCOPE INPUT SELECTOR: DC



6. Base of Q318 to chassis ground
SENSITIVITY: 0.1 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC

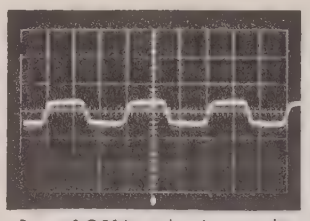


7. Base of Q309 to chassis ground
SENSITIVITY: 0.5 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC

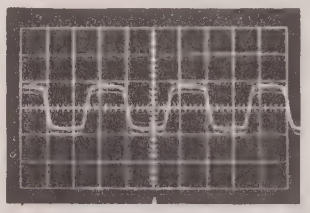


8. Base of Q317 to chassis ground
SENSITIVITY: .01 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC

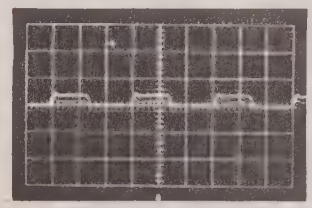
Waveforms pictured were obtained on Tektronix Model 535 with Type 53/54D Plug-in Unit.



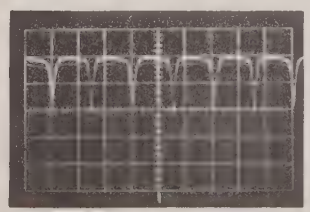
9. Base of Q316 to chassis ground
SENSITIVITY: .01 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC



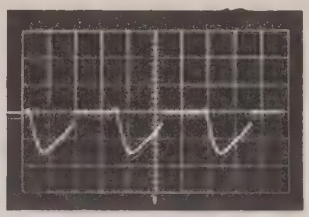
10. Pin 1 of T303 to chassis ground
SENSITIVITY: 1 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC



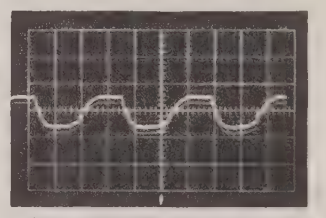
11. Collector of Q315 to chassis ground
SENSITIVITY: 1 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: DC



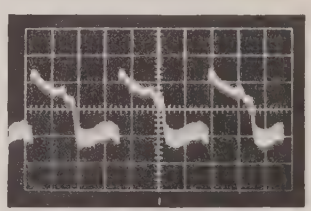
12. Emitters of Q307/Q308 *to chassis ground
SENSITIVITY: 1 V/CM
SWEEP: 500 microseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: DC



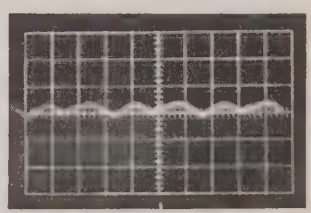
13. Junction of R410/C424 to chassis ground
SENSITIVITY: 0.5 V/CM
SWEEP: 5 milliseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: DC



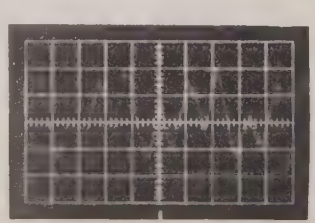
14. Plate-pin 1 of V402B to chassis ground
SENSITIVITY: 2 V/CM
SWEEP: 5 milliseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC



15. Emitter of Q404 to chassis ground
SENSITIVITY: 0.1 V/CM
SWEEP: 5 milliseconds
AMPLIFIER INPUT: +DC; GAIN: X 10
SCOPE INPUT SELECTOR: AC



16. Amplifier output terminals
SENSITIVITY: 1 mv/CM
SWEEP: 5 milliseconds
AMPLIFIER INPUT: Grounded; GAIN: X 10
SCOPE INPUT SELECTOR: DC



17. Amplifier output terminals
SENSITIVITY: 2 mv/CM
SWEEP: 5 milliseconds
AMPLIFIER INPUT: Grounded; GAIN: X 1000
SCOPE INPUT SELECTOR: DC

* Same waveform will be observed at emitters Q311/Q312

Waveforms pictured were obtained on Tektronix Model 535 with Type 53/54D Plug-in Unit.

WARRANTY

WARRANTY: KIN TEL warrants the equipment manufactured by it to be free from defects of material and workmanship under normal use and service. In consideration thereof its obligation and liability under said warranty is limited to servicing or adjusting any instrument returned to its factory for that purpose upon its written instruction, and to make good at its factory any part or parts thereof, except tubes, transistors, fuses and batteries, which shall, within one year (Instruments), or ninety days (Television) after making delivery to the original purchaser, be returned by the original purchaser to KIN TEL with transportation charges prepaid, and which in KIN TEL's examination shall disclose to KIN TEL's satisfaction to have been thus defective. No warranties other than those set forth in this section are given or are to be implied with respect to the equipment furnished hereunder.

For customer convenience, service departments are maintained throughout the United States by KIN TEL field-engineering representatives, where service is available both during and after the warranty period.

KIN TEL

COHU

ELECTRONICS

5725 Kearny Villa Road San Diego 11, California

INDIVIDUAL INSTRUMENT RECORD AND AUTHORIZATION FOR REPAIR

MODEL NO. _____ SERIAL NO. _____

CUSTOMER

PURCHASED FROM: _____ DATE PURCHASED: _____ P. O. NO. _____

SYMPTOMS NOTED: _____

_____

_____

(If application entails environmental or other specific ambient conditions which may affect operation, please describe)*

REPAIR AUTHORIZED BY: (Person, Company and Date)** _____

SPECIFIC REPAIRS REQUESTED: _____

_____

(If additional papers accompany this RECORD, please staple to this sheet. Back of this sheet may be used for further data)

SHIPPING INSTRUCTIONS FOR RETURN OF INSTRUMENT: _____

BALANCE OF THIS FORM TO BE COMPLETED BY REPAIR PERSONNEL ONLY

REPAIR DATE: _____ REPAIR ORDER NO. _____ TECHNICIAN: _____

REPAIRS PERFORMED (Including any discrepancies noted): _____

_____

_____

_____

*If classified information affects repair status, state contact for KIN TEL Security Department.

**Repair must be authorized by KIN TEL or representative personnel and this form returned with instrument.

Table 4-2. List of Replaceable Parts

CAPACITORS		KIN TEL PART NO.
C201A/B	50/100 µf 200/150V	0510044
C203A/B/C	50/10/10 µf 25/150/200V	0510058
C205A/B/C	250/250/250 µf 25/25/25V	0510018
C208A/B/C	250/250/250 µf 25/25/25V	0510018
C209	1500 µf 15V	0510045
C210	250 µf 25V	0510016
C301	125 µf 25V	0510081-018
C303	.056 µf 50V	0610034-010
C304	.01 µf 600V	0401056
C305	.01 µf 600V	0401056
C306	.01 µf 600V	0401056
C310	.0015 µf 600V	0401047
C311	.1 µf 50V	0610036-006
C312	350 µf 3V	0510075-024
C313	350 µf 3V	0510075-024
C314A/B/C	250/250/250 µf 25/25/25V	0510018
C316	8 µf 4V	0510049
C318	.0047 µf 600V	0401053
C320	.5 µf 20V	0510050
C321	.022 µf 50V	0610034-007
C322	125 µf 25V	0510081-018
C323	125 µf 25V	0510081-018
C324	1 µf 25V	0510085-003
C325	.002 µf 1000V	0410007-015
C326	.0033 µf 600V Disc	0401051
C327	.02 µf 600V Disc	0401058
C328	.02 µf 600V Disc	0401058
C329	10 µf 16V	0510085-005
C401	.1 µf 50V	0610036-006
C403	.33 µf 200V	0610013-033
C404	200 µf 3V	0510075-021
C405	.22 µf 200V	0610013-031
C406	.01 µf 600V Disc	0401056
C407	.022 µf 200V	0610013-019
C408A/B	20/20 µf 150V	0510059
C410	.033 µf 200V	0610013-021
CAPACITORS		
C411	.002 µf 600V Disc	0401048
C412	4 µf 150V	0510071-001
C414	680 µµf 600V Disc	0401042
C415	.022 µf 200V	0610013-019
C416	4 µf 150V	0510071-001
C417	350 µf 3V	0510075-024
C418	50 µf 25V	0510081-015
C420	.0047 µf 600V Disc	0401053
C421	.047 µf 100V	0610012-023
C422	.0047 µf 600V Disc	0401053
C423	.001 µf 600V Disc	0401046
C424	.01 µf 600V Disc	0401056
C425	.0047 µf 600V Disc	0401053
C426	.3 µf 50V	0610036-020
C501	.22 µf 50V	0610035-031
C502	.03 µf 50V	0610035-020
C701	.15 µf 50V	0610035-029
C702	.05 µf 50V	0610035-024
C703	.05 µf 50V	0610035-024
C704	1 µf 50V	0610035-039
C705	1 µf 50V	0610035-039
C706	.1 µf 50V Disc	0410009-104
C801	.015 µf 50V	0610043-013
C802	.002 µf 600V	0410015-003
C803	.002 µf 600V	0410015-003
RESISTORS		
R203	330 Ω 1W	0310031-331
R204	100K 1/4 W	4045000-104
R205	220K 1/4 W	4045000-224

Table 4-2. List of Replaceable Parts (Cont'd)

RESISTORS		KIN TEL PART NO.	RESISTORS		KIN TEL PART NO.
R206	3.9K 1/4 W	4045000-392	R341	6.8K 1/4 W	4045000-682
R207	47K 1/4 W	4045000-473	R342	33K 1 W	0310031-333
R210	100 Ω 1/4 W	4045000-101	R343	180 Ω 1/4 W	4045000-181
R211	15K 1/4 W	4045000-153	R344	27K 1/4 W	4045000-273
R214	1.5 Ω 1/2 W	4010001-015	R345	4.7K 1/4 W	4045000-472
R215	180 Ω 1/4 W	4045000-181	R346	0-100 Ω 1/2 W	(Factory -
R216	100 Ω 1/4 W	4045000-101			adjusted
R301	3.3K 1/4 W	4045000-332			value)
R302	4.7K 1/4 W	4045000-472	R346	27 Ω 1/2 W	0310030-270
R303	1.5K 1/4 W	4045000-152	R347	180K 1/4 W	4045000-184
R304	39K 1/4 W	4045000-393	R348	22K 1/4 W	4045000-223
R305	47 Ω 1/4 W	4045000-470	R349	10K 1/4 W	4045000-103
R306	6.8K 1/4 W	4045000-682	R350	10K 1/4 W Pot	5010179-108
R307	1.8K 1/2 W	0310030-182	R352	470 Ω 1/4 W	4045000-471
R308	47K 1/4 W	4045000-473	R353	470 Ω 1/4 W	4045000-471
R309	1.5M 1/4 W	4045000-155	R354	1K 1/4 W	4045000-102
R310	1.5M 1/4 W	4045000-155	R355	470 Ω 1/4 W	4045000-471
R311	47K 1/4 W	4045000-473	R356	2.7K 1/4 W	4045000-272
R312	1.8K 1/2 W	0310030-182	R357	27K 1/4 W	4045000-273
R313	10 Ω 1/2 W	0310030-100	R358	2.2K 1/4 W	4045000-222
R314	47 Ω 1/2 W	0310030-470	R402	10M 1/4 W	4045000-106
R316	220 Ω 1/2 W	0310030-221	R404	220K 1/4 W	4045000-224
R318	470 Ω 1/4 W	4045000-471	R405	4.7K 1/4 W	4045000-472
R319	1K 1/4 W	4045000-102	R406	10M 1/4 W	4045000-106
R320	470 Ω 1/4 W	4045000-471	R407	22M 1/4 W	4045000-226
R321	470 Ω 1/4 W	4045000-471	R408	22M 1/4 W	4045000-226
R322	1K 1/4 W	4045000-102	R409	4.7M 1/4 W	4045000-475
R323	470 Ω 1/4 W	4045000-471	R410	2.2M 1.4 W	4045000-225
R324	470 Ω 1/4 W	4045000-471	R411	330K 1/4 W	4045000-334
R325	1K 1/4 W	4045000-102	R412	4.7K 1/4 W	4045000-472
R327	180 Ω 1/4 W	4045000-181	R413	4.7M 1/4 W	4045000-475
R328	180 Ω 1/4 W	4045000-181	R414	18K 1/4 W	4045000-183
R329	120 Ω 1/4 W	4045000-121	R415	82K 1/4 W	4045000-823
R330	5.6K 1/4 W	4045000-562	R416	15K 1/4 W	4045000-153
R331	15K 1/4 W	4045000-153	R417	33K 1 W	0310031-333
R332	68K 1/4 W	4045000-683	R418	1K 1/4 W Pot	5010179-104
R333	10K 1/4 W	4045000-103	R419	3.3K 1/4 W	4045000-332
R334	6.8K 1/4 W	4045000-682	R420	10K 1/4 W	4045000-103
R335	1K 1/4 W	4045000-102	R421	9K 5 W	5110010-052
R336	680 Ω 1/4 W	4045000-681	R422	180 Ω 1 W	0310031-181
R337	120 Ω 1/4 W	4045000-121	R423	680K 1/4 W	4045000-684
R338	39 Ω 1/2 W	0310030-390	R424	1K 1/4 W	4045000-102
R339	8.2K 1/4 W	4045000-822	R425	10M 1/4 W	4045000-106
R340	560 Ω 1/4 W	4045000-561	R426	1K 1/4 W	4045000-102

Table 4-2. List of Replaceable Parts (Cont'd)

RESISTORS		KIN TEL PART NO.	RESISTORS		KIN TEL PART NO.
R427	1.8K 1/4 W	4045000-182	* R609	52.5 Ω 1/4 W 1/4 %	5210049-007
R428	56 Ω 1/4 W	4045000-560			
R429	5.6K 1/4 W	4045000-562	* R610	22.5 Ω 1/4 W 1/4 %	5210049-006
R430	12K 1/4 W	4045000-123			
R431	4.7K 1/4 W	4045000-472	* R611	1.2 K 1/4 W	4045000-122
R432	180K 1/4 W	4045000-184	* R612	3.9 K 1/4 W	4045000-392
R434	15K 1/4 W	4045000-153	* R613	10K 1/4 W	4045000-103
R435	27K 1/4 W	4045000-273	R701	8.5K 1/8 W	5210051-037
R436	22M 1/4 W	4045000-226			
R437	10M 1/4 W	4045000-106			
R438	1M 1/4 W	4045000-105			
R439	2.2M 1/4 W	4045000-225	R703	3.3K 1/8 W	5210051-036
R440	100K 1/4 W	4045000-104	R704	2.7K 1/8 W	5210051-035
R441	150K 1/4 W	4045000-154	R705	1K 1/8 W	5210051-023
R442	2.2K 1/4 W	4045000-222	R706	400 Ω 1/8 W	5210051-034
R443	12M 1/4 W	4045000-126	R707	9K 1/8 W	5210051-013
R444	1M 1/4 W	4045000-105	R708	3.9K 1/8 W	5210051-026
R445	220K 1/4 W	4045000-224	R801	25K 1/4 W Pot	5010179-109
R446	4.7M 1/4 W	4045000-475	R802	27K 1/4 W	4045000-273
R501	1K 1/4 W Pot	5010179-104	R803	150K 1/4 W	4045000-154
R502	200 Ω 1/8 W	5210051-020	R804	6.8K 1/4 W	4045000-682
R503	4K 1/8 W	5210051-027	R805	2.7K 1/2 W	0310030-272
R504	78.4K 1/8 W	5210051-032	R806	4.7K 1/4 W	4045000-472
R506	573K 1/4 W	5210052-005	R807	10K 1/4 W	4045000-103
R507	21.2K 1/8 W	5210051-029	R808	1.8K 1/2 W	0310030-182
R508	1K 1/4 W Pot	5010179-104	R809	47K 1/4 W	4045000-473
R509	10K 1/4 W	4045000-103	R810	1.5M 1/4 W	4045000-155
R510	560 Ω 1/4 W	4045000-561	R811	1.5M 1/4 W	4045000-155
R511	560 Ω 1/4 W	4045000-561	R812	47K 1/4 W	4045000-473
R512	27K 1/4 W	4045000-273	R813	1.8K 1/2 W	0310030-182
R513	180K 1/4 W	4045000-184	R814	3.9K 1/4 W	4045000-392
* R601	477 Ω 1/8 W	5210051-021	R815	68 Ω 1/2 W	0310030-680
* R602	887 Ω 1/8 W	5210051-022	R816	82 Ω 1/2 W	0310030-820
* R603	1026 Ω 1/8 W	5210051-024	R901	220K 1/4 W	4045000-224
* R604	1078 Ω 1/8 W	5210051-025	R902	5.6K 1/4 W	4045000-562
* R605	1.8K 1/4 W 1/4 %	5210049-011	R903	10K 1/4 W Pot	5010179-108
			R904	5.6K 1/4 W	4045000-562
* R606	1.5K 1/4 W 1/4 %	5210049-010	R905	220K 1/4 W	4045000-224
			R906	8.2K 1/4 W	4045000-822
* R607	525 Ω 1/4 W 1/4 %	5210049-009			
* R608	150 Ω 1/4 W 1/4 %	5210049-008			

* Part of Attenuator Assembly (KIN TEL Part No. 8023033)

Table 4-2. List of Replaceable Parts (Cont'd)

SEMICONDUCTORS		KIN TEL PART NO.
CR201	Diode 1N1169	3510014-001
CR202	Diode 1N1169	3510014-001
CR203	Diode 1N91	3506751-002
CR204	Diode 1N91	3506751-002
CR205	Diode 1N91	3506751-002
CR206	Diode 1N91	3506751-002
CR207	Diode 1N116	3503843
CR208	Diode 1N116	3503843
CR301	Diode 1N116	3503843
CR302	Diode 1N116	3503843
CR303	Diode 1N116	3503843
CR304	Diode ZA12	3510022-001
CR501	Diode 1N625	3510009
CR502	Diode 1N625	3510009
CR801	Diode 1N116	3503843
CR802	Diode 1N116	3503843
CR901	Diode ZA12	3510022-001
Q301	Transistor 2N109	7210017-109
Q302	Transistor 2N109	7210017-109
Q303	Transistor 2N109	7210017-109
Q304	Transistor GT35	7210022-004
	OR 2N35	7210017-035
Q305	Transistor 2N270	7210017-270
Q306	Transistor GT75X	7290010-001 Coded BROWN
Q307	Transistor GT75X	
Q308	Transistor GT75X	7290010-002 Coded RED
Q309	Transistor GT75X	
Q310	Transistor GT75X	7290010-003 * Coded ORANGE
Q311	Transistor GT75X	
Q312	Transistor GT75X	7290010-004 Coded YELLOW
Q313	Transistor GT75X	
Q314	Transistor GT35	7210022-004
Q315	Transistor GT20	7210022-003
Q316	Transistor GT35	7210022-004
Q317	Transistor GT35	7210022-004
Q318	Transistor 2N175	7210017-175
Q319	Transistor GT35	7210022-004
Q401	Transistor 2N109	7210017-109
Q402	Transistor 2N301	7210017-301
Q403	Transistor 2N109	7210017-109
Q404	Transistor 2N109	7210017-109
Q405	Transistor MF7210017-247 (modification of Transistor 2N247)	7210021
Q801	Transistor 2N109	7210017-109
Q802	Transistor 2N109	7210017-109
Q803	Transistor 2N109	7210017-109
Q804	Transistor 2N109	7210017-109
Q805	Transistor 2N270	7210017-270
Q806	Transistor GT35	7210022-004
	OR 2N35	7210017-035
VACUUM TUBES		
V401	5751	7302812
V402	12AT7	7002711
MISCELLANEOUS		
D101	Chopper (Input)	6310007
D401	Chopper (Output)	6310006
DS201	Lamp NE-2A	1710036-002
DS202	Lamp NE-2	1704151
DS203	Lamp NE-2	1704151
F101	Fuse 1/4 A Slo-Blo	1710040-010
J102	Connector (Filter)	1310066-001
J201	Connector (Chassis)	8023054-001
S601	Switch	6210016-001
T101	Transformer (Power)	6510041
T102	Transformer (Input)	6510039
T301	Transformer (Blocking Oscillator)	6510026
T302	Transformer (Demodulator Reference)	6510040
T303	Transformer (Demodulator Signal)	6510040

* Part of Attenuator Assembly (KIN TEL Part No. 8023033)

KIN TEL MODEL 114A DIFFERENTIAL AMPLIFIER
CALIBRATION DATA

SERIAL NO. _____ DATE _____

P-P mv OUTPUT NOISE (1000 Ω Load)

P-P EQUIV INPUT NOISE	X1000	X300	X100	X30	X10
1 KC	<10_____	<3_____	<1_____	<.6_____	<.5_____
60 cps	<5_____	<1.5_____	<.5_____	<.27_____	<.27_____
3 cps	<3_____	<.9_____	<.3_____	<.09_____	<.06_____

ZERO CONTROL _____

DC GAIN DEVIATION <±.86%

1000 Ω Load X10_____% X30_____% X100_____% X300____% X1000_____%

OVERLOAD RECOVERY X100 GAIN

1000 Ω Load <3 SEC _____
.6 μf Load <3 SEC _____

DC LINEARITY X100 GAIN 1000 Ω Load

+.5 V_____	+1 V_____	+2 V_____	+6 V_____	+10 V_____
<±.045%	<±.045%	<±.045%	<±.085%	<±.085%
-.5 V_____	-1 V_____	-2 V_____	-6 V_____	-10 V_____

10 cps GAIN DEVIATION <±.86% 1000 Ω Load

X10_____% X30_____% X100_____% X300_____% X1000 _____%

10 cps LINEARITY X100 GAIN

1000 Ω Load

DISTORTION AT P-P OUTPUT LEVEL	1 V	20 V
P-P DISTORTION	_____%	_____
GAIN DEVIATION <±.86%	_____%	_____

100 Ω Load GAIN DEV. <±1.86% + 1000 Ω Gain Dev. _____%

40 cps GAIN DEVIATION <±1.86% 1000 Ω Load X100_____%

3 db ROLL OFF X100 GAIN (>120 cps)_____cps

DC INPUT COMMON MODE REJECTION 166 db

Input

Balanced _____
Unbalanced Neg. _____
Unbalanced Pos. _____

60 cps COMMON MODE REJECTION 120 d

Input

Balanced _____
Unbalanced Neg. _____
Unbalanced Pos. _____

DRIFT 15 Min. x 30 <± 5 μv _____ CHECKED BY _____

Rev. Form No. P-244

KIN TEL MODEL 114A DIFFERENTIAL AMPLIFIER
CALIBRATION DATA

SERIAL NO. _____ DATE _____

P-P mv OUTPUT NOISE (1000 Ω Load)

P-P EQUIV INPUT NOISE	X1000	X300	X100	X30	X10
1 KC	<10_____	<3_____	<1_____	<.6_____	<.5_____
60 cps	<5_____	<1.5_____	<.5_____	<.27_____	<.27_____
3 cps	<3_____	<.9_____	<.3_____	<.09_____	<.06_____

ZERO CONTROL _____

DC GAIN DEVIATION <±.86%

1000 Ω Load X10_____% X30_____% X100_____% X300_____% X1000_____%

OVERLOAD RECOVERY X100 GAIN

1000 Ω Load <3 SEC _____

.6 μf Load <3 SEC _____

DC LINEARITY X100 GAIN 1000 Ω Load

+.5 V_____	+1 V_____	+2 V_____	+6 V_____	+10 V_____
<±.045%	<±.045%	<±.045%	<±.085%	<±.085%
-.5 V_____	-1 V_____	-2 V_____	-6 V_____	-10 V_____

10 cps GAIN DEVIATION <±.86% 1000 Ω Load

X10_____% X30_____% X100_____% X300_____% X1000_____%

10 cps LINEARITY X100 GAIN

1000 Ω Load

DISTORTION AT P-P OUTPUT LEVEL	1 V	20 V
P-P DISTORTION	_____%	_____%
GAIN DEVIATION <±.86%	_____%	_____%

100 Ω Load GAIN DEV. <±1.86% + 1000 Ω Gain Dev. _____%

40 cps GAIN DEVIATION <±1.86% 1000 Ω Load X100_____%

3 db ROLL OFF X100 GAIN (>120 cps)_____cps

DC INPUT COMMON MODE REJECTION 166 db

Input

Balanced _____
Unbalanced Neg._____
Unbalanced Pos. _____

60 cps COMMON MODE REJECTION 120 db

Input

Balanced _____
Unbalanced Neg._____
Unbalanced Pos. _____

DRIFT 15 Min. x 30 <± 5 μv _____

CHECKED BY _____

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10-3-58

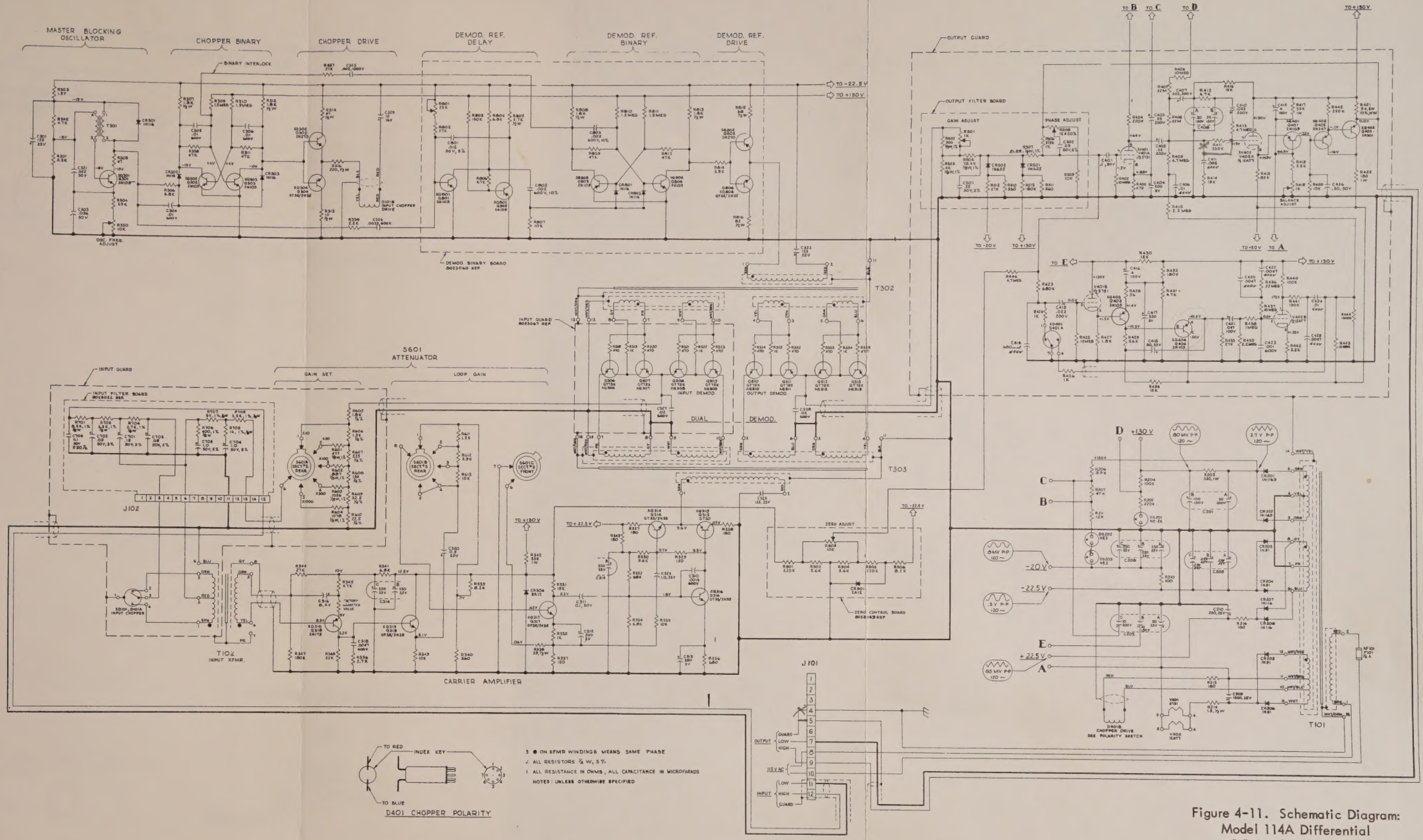

Figure 4-11. Schematic Diagram: Model 114A Differential DC Amplifier Drawing No. J-8023200